

must begin, rather than with the fragmentary and uncertain relics of older phases of faith.

In his introduction to the first volume, Prof. Max Müller offers some useful words of warning to those who approach the study of these old texts with exaggerated ideas of Eastern wisdom and profundity. "By the side of so much that is fresh, natural, simple, beautiful, and true," there is "much that is not only unmeaning, artificial, and silly, but even hideous and repellent." The extracts culled from them by popular writers, in order to illustrate the exalted character of ancient thought, too frequently stand by the side of other passages which painfully recall the infirmities of human nature. Mankind has worked its way but slowly to its present level of knowledge and enlightenment, and the mixed character of these ancient books may serve to remind us that we, too, have our infirmities and imperfections which will seem as strange to a future generation as those of Eastern sages do to us. Man is the creature of his age, and the best and wisest among us cannot escape from the influences that surround us, and the limitations imposed by the knowledge and prejudices of our own day.

These translations will be useful in dispelling another illusion which the enthusiastic pioneers into the realm of Oriental religion have occasioned. They are as faithful and accurate as the present state of philological science allows, and the reader will, therefore, miss the modern ideas that have too often been read into passages quoted from the sacred books of the East. By changing a word here, and inserting a word there, by assimilating the expressions of the original to the familiar language of our own Scriptures, a false impression of the character of these old books has not unfrequently been produced.

The Upanishads, with which the series of translations opens may be described as the text-books of sacred Hindu philosophy. They preceded the era of the Sūtras, or grammatical treatises on the Veda, the beginning of which may be roughly placed about 600 B.C., and form part of that of the Brāhmanas or Vedic commentaries. They embody the traditional doctrines of the Brahmins regarding the highest objects of human interest and inquiry, and in many cases may be shown to have been incorporated into a Brāhmaṇa. They aim at ascertaining the mystic sense of the Veda, and so lay the foundation of the later Hindu metaphysical systems. At the same time they are not exclusively Brahmanical; on the contrary, they seem composed rather in the interest of the Kshatriya Kings than of the priestly Brahmins. About 150 of them exist, partly in prose, partly in verse, out of which Prof. Max Müller has selected five of the most important to place before the English reader. It must be remembered that, like the Brāhmanas, the Upanishads form part of the inspired Hindu Canon.

The sacred laws of the Hindus, as taught in the schools of Apastamba and Gautama, occupy the second volume of the series. They belong to the Sūtra period of Indian literature, and we have not to read them long to discover the tyrannically Brahman spirit which they breathe. Dr. Bühler considers that the Gautama Dharmasāstra is in the main the oldest of existing works on sacred Hindu law. He further places Apastamba at latest in the fourth or fifth century B.C. A translation of the laws taught in

the schools of Vāsishṭha and Baudhāyana will follow in another volume.

The third volume contains Dr. Legge's translations of the texts of Confucianism, the Shū King, the Shih King, and the Hsiāo King. The Shū King is a collection of historical records, beginning with the reign of Yáo in the twenty-fourth century B.C., and coming down to that of Hsiang B.C. 961. The Shih King or Book of Poetry consists of 305 ancient poems, five of which belong to the time of the Shang dynasty (B.C. 1766-1123), and the rest to that of the dynasty of Cháu (B.C. 1123-586). Its philological and literary value is naturally very great. The short treatise known as the Hsiāo King, or classic of filial piety, is regarded by Dr. Legge as containing a Confucian element, but mostly composed in the first century before our era. Astronomical and other reasons on the other hand, dispose him to accept the antiquity claimed by the Shū and the Shih.

Prof. Max Müller may be congratulated on the successful commencement of his great undertaking. The publication of other sacred texts, including the Korân, the works of Lao-tse, and selected portions of the Buddhist and Zoroastrian Scriptures, are expected soon to follow. For obvious reasons, however, the sacred books of ancient Egypt and Babylonia, of which we now possess considerable fragments, have been excluded from the series. The Book of the Dead, the most important part of the Egyptian Canon, will be independently issued before long in a revised text and revised translation, while we must wait for future excavations to complete the mutilated hymns of early Chaldea, a portion only of which is at present in our hands. For many years yet we shall have to be content with collecting and preparing the materials that others will use, with sowing the seed which another generation will harvest. We have, indeed, come to realise that there is a science of religion, but it will necessarily be long before the science has passed out of its first classificatory stage.

A. H. SAYCE

MODERN CHROMATICS

Modern Chromatics, with Applications to Art and Industry. By Ogden N. Rood. International Science Series. (London: C. Kegan Paul and Co., 1879.)

IN Sir Charles Eastlake's preface to his translation of Goethe's "Theory of Colours," he took occasion to pronounce against the accepted theory of Newton (that white light consists of coloured lights compounded together), in the following sentences:—

"It must be admitted that the statements of Goethe contain more useful principles in all that relates to the harmony of colour than any that have been derived from the established doctrine. It is no derogation of the more important truths of the Newtonian theory to say that the views it contains seldom appear in a form calculated for direct application to the arts."

Since the time of Sir Charles Eastlake, however, great strides have been made in the theory of colour. The work of Prof. Rood now before us is the latest contribution to this branch of science; and in dealing with "Modern Chromatics," the author has brought to bear not merely a profound acquaintance with the work of all recent scientific writers on colour-theory, but also an intimate knowledge of the artistic and decorative functions

of colour. The reproach laid against the true colour-theory of Newton that it was less fruitful for artistic ends than the false theory of Goethe, is impossible in the face of such modern works as those of Chevreul, Field, Helmholtz, Brücke, and von Bezold. And now Prof. Rood's new work will be welcomed as an addition to the literature of the subject.

The first two chapters are devoted to the general laws of light, and of its dispersion by refraction and by diffraction. Then comes a chapter on the three "constants" of colour, *purity*, *luminosity*, and *hue*, the term luminosity being employed, not as artists sometimes employ it to describe a particular "effect" of light and shade in a picture, but as the equivalent of the measurable intensity or brightness of the light. The author avoids the term "intensity" in this sense, that it may not be confounded with the term "saturation," a quality of colour which depends upon both purity and luminosity, and which is also sometimes erroneously spoken of as the "intensity" of a colour. The four following sections deal with the production of colour by interference and polarisation, by turbid media, by fluorescence and phosphorescence, and by absorption. The last of these chapters is very carefully written, and contains spectroscopic diagrams of a number of absorbing media. Their bearing upon the all-important question of the tint transmitted by two coloured media jointly is clearly explained. The remaining chapters are devoted to Young's Theory, Mixture of Colours, Complementary Colours, Colour Systems, &c. A concluding chapter deals with Painting and Decoration.

Following von Bezold, Prof. Rood rejects the term "indigo" introduced by Newton into the classification of the spectrum colours, and describes the colours between green and violet as *blue-green*, *cyan-blue*, *blue*, and *violet-blue*. The spectrum line F stands between "cyan-blue" and "blue," while "violet-blue" begins about half-way between F and G, and ends a little beyond the latter line. This classification differs slightly from that of Listing.

A detailed account is given of Maxwell's Theory of Colours, of the experiments by which he arrived at his results, and of the colour-chart devised by him. It is unfortunate, however, that the author has divided his excellent remarks on this head, giving part in an appendix to Chapter VIII., part in another appendix to Chapter XIV., and the elementary explanation of the method of balancing the colours upon p. 219 of the text. Apart from this awkward arrangement the matter is admirably put; and is the best exposition of Maxwell's theory in the language. Indeed it is singular that most English textbooks ignore Maxwell's work in this department. In the English edition of Deschanel's "Natural Philosophy," which is almost the only one which touches the matter at all, the brief paragraph in which the theory is dealt with lacks the perspicacity that mostly distinguishes that well-known work.

There are one or two sentences in the work which cannot command our assent; and should be revised when another edition is called for. Thus, on p. 86, we are told that Becquerel and other earlier experimenters succeeded in obtaining fleeting photographs of the colours of the spectrum, but that "the colours thus obtained are produced merely by the *interference* of light." And again,

"In blue eyes there is no real blue colouring matter *at all*" (p. 58). On p. 94 the author claims as his own an experiment described originally in this country by T. Rose, the inventor of the kalotrope. A reference is given on p. 82 to the darkening of tint of water when heated, due to increased absorption: but the author makes no reference whatever to the important observations of Gladstone, Hartley, and Ackroyd on the similar changes which take place in almost all coloured bodies when heated; nor to the significant observation of the last-named experimenter, that with increasing temperature the absorption appears to increase most in the blue end of the spectrum in the case of those solid bodies of fixed composition which expand with a rise of temperature, while it increases most at the red end for those few bodies such as iodide of silver which contract with a rise of temperature. Hering's theory of colours deserves a more extended notice than the very short note given in the final appendix. A brief account is given on p. 83 of a simple means devised by Simmler for observing the red rays which are abundantly reflected by green leaves: a thick plate of blue cobalt glass in conjunction with a plate of yellow glass serving to cut off all rays except the red and the blue-green. The writer of this notice independently described some few years ago a similar device, in which by taking a solution of permanganate of potash in a glass tank of a convenient size, the blue, green, and yellow rays were similarly absorbed, allowing only red and violet bands to pass, thus constituting, like Simmler's double plate, an erythroscop.

The portions of Prof. Rood's book which bear upon artists' work are numerous, and his observations are of importance. There is, for example, a careful discussion of the change of visible tint suffered by coloured surfaces under diminished illumination; and a parallel discussion of the results obtained by mixing pigments with a proportion of black. A list is given of those pigments which are liable to change or fade by exposure. The reason why oil colours do not materially change their tint on drying is carefully argued; and the *rationale* of Pettenkofer's "regeneration" process for picture-restoring is given. Chapter IX. sums up the indisputable evidence for regarding red, blue (or violet), and *green*, and not red, blue, and *yellow*, as the three fundamental colours, and later on is discussed the reason why a greater luminosity is obtained in mixing two colours optically, or by laying them side by side in minute touches, than is obtained by laying them over one another or by mixing them on the palette; and the author adds no less truly than concisely: "every mixture of pigments on the painter's palette is a *stride toward blackness*."

We can commend the volume to the notice of all who study colour, whether from an æsthetic or a scientific point of view.

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OUR BOOK SHELF

Zeitschrift für das chemische Grossgewerbe. Kurzer Bericht über die Fortschritte der chemischen Grossindustrie. In Vierteljahres-heften, iii. Jahrgang. Unter Mitwirkung angesehener Technologen und Techniker. Herausgegeben von Jul. Post. (Berlin: Verlag von Robert Oppenheim, 1879.)

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